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ABSTRACT

This guide describes options for the Granville schools when dealing with pests. It is based on Integrated Pest Management (IPM), a philosophy that employs safe and practical pest control methods. The guide can be used to incorporate IPM philosophy into the school systems. The first section provides the environmental context for an interest in pesticide reduction, focusing on the risk pesticides pose to children's health. The next section assesses the current conditions at Granville schools (frequently encountered pest problems, methods used to combat them, and inspection of schools for possible behaviors and structural conditions leading to the problems). The next section suggests ways that IPM can be used, not just as a pest management tool, but also as an educational supplement. It discusses how IPM can be used in the classroom as a resource for learning. It goes on to provide a guide to IPM methods of pest management. It is tailored to address the specific pests of concern in the Granville schools. The final section proposes a policy statement for the Granville schools regarding pest management, and it provides a list of complementary sources of additional information for maintenance staff, teachers, parents, and students. (SM)

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BUG OFF
A Guide for Integrated Pest Management in Granville Schools

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To Granville School Leaders:

During the course of the semester, we have researched an important issue: pesticide use in schools. With the cooperation and help of school administrators, teachers, and maintenance staff, we have completed an assessment of pest problems and management strategies in the Granville schools. We found that while pest management is not currently a major challenge or concern for Granville Schools, pesticides nonetheless are periodically used. There are steps you can take to reduce or avoid reliance on chemical means of pest control. Doing so will protect both students and the environment from the potential dangers of these toxins. We are providing this guide describing options you have when dealing with pests.

The guide is based on Integrated Pest Management (IPM), which is a philosophy employing safe and practical methods of pest control. The guide can be used to incorporate IPM philosophy and practice in the school systems. We encourage you to take our suggestions into consideration. We know that the safety of your students is your highest priority. The adoption of IPM will reduce and perhaps eliminate any harmful chemicals from reaching children in school.

The first section of the guide provides the environmental context for our interest in pesticide reduction, focussing in particular on the risk they pose to children's health. Following that section is a formal definition of IPM. The next section consists of our assessment of current conditions at Granville Schools: both the pest problems encountered most frequently, the methods used to combat them, and our inspection of the schools for possible behaviors and structural conditions that lead to the problems. Together, this assessment allows us to make recommendations for how to address specific pest problems using least toxic means. The next section suggests ways that IPM can be used not just as a pest management tool, but also as an educational supplement. We highlight ways that IPM can be used in the classroom as a resource for learning. We then provide you with a guide to IPM methods of pest management. The guide has been tailored to address the specific pests of concern in the Granville schools. The concluding section proposes a policy statement for the Granville Schools regarding pest management. We also provide a list of complementary sources of additional information for maintenance staff, teachers, parents, and students.

A strength of IPM, as reflected in this guide, is its flexibility. It allows you to choose the aspects of the IPM program that best match the needs of the schools. We stress that there is never just one solution to a problem. There are many options and choices, and oftentimes, utilizing more than one approach to a problem provides not just a short-term solution but is an effective means of preventing recurrences.

We encourage you to utilize the work that has been provided for your school district. Thank you very much for your time and consideration.

The class of 2001: Environmental Studies Capstone Seminar

Human Health and the Environment

Pesticides are a threat to the health of humans and the environment. The most frequently used pesticides are chemical poisons, designed to kill or control organisms society does not want and designates as "pests." But pesticides rarely harm only the targeted "pest" (Rachel Carson Council n.d.). Because of this, we need to identify and adopt benign alternative pest management practices. Although use of pesticides may be appealing because they are seemingly practical, simpler, and in some cases more economically feasible, the potential health risks involved outweigh possible advantages. This section specifies human health hazards and problems with pesticide use as a precursor to an explanation of alternative methods of pest management.

The effects of pesticides on the human body are not completely understood, though one thing that is known with certainty is that the dangerous effects of pesticides may not be immediately visible to those who have been exposed; symptoms of exposure to toxic chemicals may not become apparent until many years following the initial exposure (Carson 1962:188). Although single incidents of exposure can be serious enough to lead to poisoning, it is the frequent exposure to unnoticeable amounts of chemicals that should be of concern: "The biological effects of chemicals are cumulative over long periods of time, and . . . the hazard to the individual may depend on the sum of the exposures received throughout [one's] lifetime" (Carson 1962:188).

We should give special consideration to the issue of children and their exposure to pesticides. Children are more susceptible to pesticide poisoning than adults (Carson 1962:23; Daar et al. 1997). This is especially unfair to children, who remain largely ignorant of the fact

that they are being exposed. Children experience greater health risks from pesticides compared to the health risks involved with adults because

> [p]ound for pound of body weight, children not only breathe more, eat more, and have a more rapid metabolism than adults, but they also play on the floor and lawn where pesticides are commonly applied. Children have more frequent hand to mouth contact as well (U.S. Environmental Protection Agency n.d.).

Not only do children take in more pesticides (relative to body weight) than do adults, they are less able to detoxify these chemicals (Physicians for Social Responsibility 2000). Since young children's brains and bodies are still developing, they are particularly susceptible to lung damage, damage to the nervous, endocrine, reproductive, and immune systems, and to cancer (Northwest Coalition for Alternatives to Pesticides 2000; Center for Health, Environment, and Justice 2000).

Although it is common to focus on short-term effects, we need also to study long-term effects when dealing with safety issues with children. Pesticides and other chemicals often operate in such a covert manner that humans allow themselves to give chemical exposure no notice until it is too late. This is another reason why children are at particular risk – because of the uncertainty and the invisibility of chemical exposure beginning at such an early age. We must combine an understanding of the special physiological vulnerability of children with recognition that pesticides rarely effect only their targets, that pesticide residues may drift to unintended areas, and that the residues persist over long periods of time (Center for Health, Environment, and Justice 2001; Northwest Coalition for Alternatives to Pesticides 2000). With this understanding, it becomes clear that we must take an immediate stance regarding use of chemical pesticides.

Compelled by this logic, major national organizations have called for the elimination of chemical pesticides in schools and the adoption of IPM. The Board of Directors of the National

PTA issued a 1992 Position Statement recognizing the adverse health effects of pesticides and encouraging schools to use an IPM approach to managing pests (National PTA 1992). Physicians for Social Responsibility has taken a position strongly supporting passage of laws that will mandate prior notification of the use of pesticides and which encourage adoption of IPM approaches (Physicians for Social Responsibility 2000). With necessary precautions, we will not only ensure the longevity of our physical environment, but we can, more importantly, ensure the health and safety of our children and future generations.

IPM: A Definition

Now that we have described how pesticides are harmful to the environment and to children, it is important to discuss the available solutions to traditional pest control methods. Through background research and with the help of experts, we have learned the many advantages of Integrated Pest Management. Below we give a general definition of IPM based on our research.

Integrated Pest Management, IPM, is a decision-making process where the selection, integration, and implementation of pest control (biological, chemical or cultural) relies on predicted economic, ecological and sociological consequences. IPM programs use information on the life cycles of pests and their interactions with the environment. The information is used to manage pests with the least possible hazard to people, property, and the environment. The basis of IPM methodology is removing some of the basic elements pests need to survive (air, moisture, food and shelter). IPM creates an environment that is unattractive to pests through regular maintenance, sanitation, and inspection, to find and correct conditions that encourage pests before pests become a problem.

Integrated Pest Management is a safe and effective tactic for controlling pests. We argue that IPM can and should be adopted by the Granville schools. In the next section, we apply this definition of IPM to an assessment of current pest conditions in the Granville school district and in making recommendations for actions regarding pest management. Elsewhere in this guide we discuss the specific methods IPM uses to contend with the pests most common in the schools.

Current Conditions in Granville Schools

One of the most important aspects of Integrated Pest Management is to evaluate what pests are present, where, and why. In keeping with this, our class gathered specific information on the Granville High School, Middle School, and Elementary School. One source of information was Dave Kitner of Omega Pest Control, who was very helpful in providing us with information on the pest problems that face each of the schools, and the specific pest management practices that are used to alleviate such problems. In order to determine potential problem areas, a small group from our class, with the assistance of John Kline, performed a walk-through assessment of each of the schools. Mr. Kline was very helpful throughout the assessment, and provided us with a great deal of useful information.

The following pages provide an overview of each school and, our walk-through inspection of each. A detailed table summarizes problem spots and recommendations for dealing with them. While pest problems are not sever, intolerable levels of some pests (that is, levels above a threshold for action) do occur, at least periodically. When that occurs, chemicals are the typical response. Our assessment shows that many of these problems could be avoided by relatively simple actions taken to prevent pests through reducing their access to water, food, and habitat. This will save the schools money in the long run and, most importantly, reduce the risk of chemical exposure for all staff, parents, and especially, children.

Granville High School

Background

- Number of students: 775
- Number of faculty/staff: 58
- Foundation type: concrete slab
- Pest problems (according to John Kline and Dave Kitner):
  1. Yellow jackets in outdoor eating area, American government room, and near the arts room
  2. Ants near the vending machine
  3. Recently, some roaches have been found in a small locked area near the vending machines.
- Specific pest treatment:
  1. General school grounds are not sprayed for weeds or insects. Football fields are sprayed for weeds once a year following the football season. Baseball fields are sprayed twice a year for weeds following the baseball season and in the fall.
  2. Roaches are treated with Beemin, a powder insecticide that can be inserted in cracks and crevices.

Food Situation

Cafeteria/Kitchen

- Cookies are the only food prepared in the building.
- The food preparation area is equipped with ovens, refrigerators, and some other basic appliances.
- Ovens are elevated to prevent dust collection and providing homes to critters.
- The refrigerators are used only to store individuals' lunches during the school day. No food product is allowed to remain in the food preparation area overnight.
- This area is also used as a concession stand for school activities. During this time, food items such as candy bars could be left in the area overnight.
- Lunch is brought to school individually by students, faculty, and staff, and cafeteria food is shipped from Newark.

Vending Area

- Vending machines are available to students and faculty in a vending room near the cafeteria.

Other

- There is a second kitchen in the home economics classroom.

Waste Disposal

- Trash cans throughout the school are emptied daily into dumpsters, which are also emptied daily.
- Dumpsters are switched with clean replacements once a year.
- Rainwater spouting is enclosed and discharges into a central pipe under the building.

Heating and Air Conditioning

- Air conditioning units are located on the roof of the building in an enclosed area.

Our Observations

Vending Area

- An accumulation of debris was found behind the vending machines.
- Possibility of condensation behind and below the machines
- An open drain was found on the floor near the vending room.

Cafeteria/Kitchen

- Small water spots on the ceiling tiles were found in areas throughout the building.
- Food preparation area is kept clean.
- Cracks were found in between the metal guards and the walls in the kitchen.
- Drains on grease traps do not work as well as they could sometimes.
- The kitchen area does not always get mopped at night.
- Cardboard boxes were found under the elevated ovens in the kitchen.

Exterior

- There are trees against the outside walls of the building.
- Either mulch or grass is what leads up to the base of the building (different from one area to the next).
- Mercury-vapor bulbs are used to light the outside of the building at night. Right now this is a continual lighting process, however, the school is looking into motion-sensor lighting.

General

- Seals on the majority of the interior/exterior doors are good. The doors from the outside eating area to the cafeteria are questionable.
- Cinder block walls
- Hollow wall base along a large window in the cafeteria
- Cracks in the foundation

Granville High School	Observations	habitat	food	water	Recommendation
Classrooms/ Lounge	Food sitting out in faculty lounge.	X	X		Place all food items in refrigerator after eating. Perishable items need to be stored in sealed containers. These precautions will help eliminate favorable conditions that attract pests.
	Water spots on ceiling tiles found throughout building.			X	Remove standing water and replace water-damaged material. Regularly clean areas that are prone to water accumulation.
Lockers	Left over lunch bags left sitting in lockers.	X	X		Routinely clean lockers and desks.
Vending machine Area	An accumulation of debris was found under and behind machines.	X	X		Regularly clean under the vending machines.
	Possibility of condensation behind and below the machines.			X	Keep areas as dry as possible by removing standing water and water damaged or wet material. Increasing ventilation may be necessary to increase rate of evaporation.
	Open drain found on floor.	X			Cover drain in order to decrease the potential of habitat for a number of pests. A drain may be a good passageway for pests to get into the inside of the school. Additionally, because the drain is located in the vending machine area, this risk is increased.
Commons Area/ Food Preparation Area	Concession stand candy is left overnight.	X	X		Be sure to place any candy or left over food in sealed containers. Check the refrigerator on a regular basis to get rid of any remaining food that might be left by faculty or students.
	Hollow wall base along windows in the cafeteria.	X			Replace with solid bases in order to eliminate places for pests to live.
	Cracks found in walls.	X			Repair and seal all cracks.
	Cardboard boxes were found under elevated ovens.	X	X		Clean under ovens every time they are used. Replace the cardboard box, which when gets wet grows mold, with a rubber mat. This also allows for easier inspection.
	Doors leading to outside area are not sealed efficiently.	X			Seal doors and windows by applying a weather strip.
	Grease drains are not efficient.	X	X		Fix drain in order to prevent habitable locations and attractive food source for pests.
Building	Water spots on ceiling tiles.			X	Remove standing water and replace water-damaged material. Regularly clean areas that are prone to water accumulation.

Granville Middle School

Background

- Number of students: 461
- Number of faculty/staff: 40
- Foundation type: concrete slab
- Pest problems (according to John Kline and Dave Kitner)
  1. Ants near the vending machines and around exterior walls
  2. Yellow jackets, particularly at the beginning and end of the school year, around the industrial arts room and windows
- Specific pest treatment:
  1. General school grounds are not sprayed for weeds or insects.
  2. Yellow jackets are treated (off-hours) with Ficam, a dust that can be injected into holes.

Food Situation

General

- Lunch is brought to school individually by students, faculty, and staff, and cafeteria food is shipped from Newark.
- Students who bring a lunch to school keep it in their lockers.
- Vending Area
- Vending machines are available to the students near an exit from the cafeteria and to the faculty in the teachers' lounge.

Waste Disposal

- Trash cans throughout the school are emptied daily into dumpsters, which are also emptied daily.
- Rainwater spouting is enclosed and discharges into a central pipe under the building.

Heating and Air Conditioning

- Air conditioning units, boilers, and hot water tanks are located on the roof of the building in an enclosed area.

Our Observations

Vending Area

- There is some condensation and an accumulation of debris under the vending machines.
- Exterior
- Trees, mulch, and grass all lead up to the outside edges of the building.

General

- Seals on all interior/exterior doors are good.
- Water spots were found on ceiling tiles throughout the school (cafeteria, hallways, etc.).
- Cinder block walls
- A crack in the wall was found in the corner of the teachers' lounge.

Graville Middle School	Observations	Habitat	Food	Water	Recommendations
Classrooms/Lounge	Crack in wall of faculty lounge. Left out food.	X	 X		Seal crack in order to eliminate pests accessibility to interior of building. Clean up all food products. Place items in refrigerator. Perishable items need to be stored in sealed containers.
Lockers	Students store lunch in lockers.	X	X		Routinely clean lockers and desks for food.
Vending machine area	Found ants under machines. Condensation under the machines.	X	X	 X	Clean regularly under machines in order to get rid of debris. Routinely vacuum carpeted areas. Keep areas as dry as possible by removing standing water and water damaged material. Regularly clean areas that are prone to water accumulation. Increased ventilation may be necessary to increase rate of evaporation.
Building	Water spots were found on ceilings.			X	Remove standing water and replace water-damaged material. Regularly clean areas that are prone to accumulation of water.

Granville Elementary School

Background

- Number of students: 608
- Number of faculty/staff: 45
- Foundation type: crawl space
- Pest problems (according to John Kline and Dave Kitner):
  1. Pavement ants in the addition, especially around the dining area
  2. Mice and other rodents in the old section, due to the crawlspace running underneath
- Specific pest treatment:
  1. General school grounds are not sprayed for weeds or insects.
  2. Mice are treated with Talon-G (a mouse bait) in the crawlspace.
  3. Skunks and groundhogs are chased out of the crawlspace, and points of entry are sealed.
  4. Pavement ants are treated with Maxforce Ant Bait.
- Age of building: 50 yrs (Addition: 3 yrs)

Food Situation

Cafeteria/Kitchen

- There are food-heating systems and coolers on rollers in the kitchen.

General

- Lunch is brought to school individually by students, faculty, and staff, and cafeteria food is shipped from Newark.

Classroom

- Teachers keep snacks for the children in their classrooms.
- Individual lunches are kept in a holding area in each classroom. The holding area is not refrigerated (usually just a wooden rack along one of the walls); thus, it is up to the children's parents to put cold packs in with the lunches.

Teachers' Lounge

- There is a refrigerator and some small appliances in the teachers' lounge.

Waste Disposal

- Trash cans throughout the school are emptied daily into dumpsters, which are also emptied daily.
- Rainwater spouting is enclosed for the most part, yet it does not lead underground to a central pipe. Spouting simply leads to the base of the building.

Heating and Air Conditioning

- The boiler room is in the basement of the building. The steam produced in the boiler room is fed to the classrooms via pipes that run through the crawl space beneath the building.

- Vents below the windows in the old classrooms can be opened up to allow air to enter the classrooms.
- There is no air conditioning in the building.

Our observations

Food

- Food sitting out in the teachers' lounge
- One teacher had treats for her students (animal crackers) next to a window in the classroom.

Cafeteria

- Tables in the cafeteria fold into the wall, making it hard to keep them clean. Gaps are created between the tables and walls, which makes space for the accumulation of food and possible space for critters. This area gets power washed once a year.
- Large gap in the bottom seal of the exterior door of the loading area near the cafeteria.

Boiler Room

- The boiler room is very damp.
- The old, coal-burning boiler sits vacant.
- Cob webs on the ceiling of the boiler room
- Dirt covering the floor of the boiler room
- Open drains were found on the floor of the boiler room.
- Dripping pipes were found overhead in the boiler room.

Exterior

- Mulch is covering the playground.
- Trees, grass, and mulch lead to the building's exterior walls.

General

- School grounds are located next to the Granville golf course.
- Several live plants are in the building.
- We found cracks in the walls.
- Interior/exterior door seals are not very good. The exit door from the boiler room is in very bad shape.
- Some of the building has carpeted floors.
- Cinder block walls
- We found gaps in between some of the cinder blocks
- We found small holes through the walls and floor to the crawl space.
- Drilled holes were found in walls throughout the building.
- Most of the interior doors are hollow with hollow frames.
- There are a number of open windows at the base of the building that led to the basement and crawl space. These windows and much of the windows in the classrooms are hinged and open into the building.
- Some drop-ceiling tiles in the addition showed signs of debris and water accumulation.
- A piece of carpet was placed under a drinking fountain for safety.

Granville Elementary School	Observations	Habitat	Food	Water	Recommendations
Classrooms/ Lounge	Student's lunches are kept in the classroom.	X	X		Keep food items away from windows and doors. Use plastic seal able containers to store the lunches in the classrooms. Clean the containers on a weekly basis, or daily if there is a spill or leak.
Building	Several live plants.	X		X	Keep the plants healthy. A dying plant may be a sign of a parasite.
	Rainwater sprouting system.			X	Provide adequate drainage away from the structure and on the grounds.
	Cracks in the walls.	X			Repair and seal all cracks.
	Interior/exterior doors are in poor condition.	X			Seal doors by applying a weather strip to prevent pests from entering the building.
	The boiler room accumulates a lot of moisture.	X			Increase ventilation or install a dehumidifier. It is necessary to decrease moisture in order to eliminate a necessary living condition for pests.
	Dripping pipes found.	X		X	Keep areas as dry as possible. Replace dripping drain or repair leak.
	Gaps found in between some of the cinder block walls.	X			Fill these gaps in order to prevent pests from living there and in order to prevent accessibility to the inside of the building.
	Drilled holes were found in walls throughout building.	X			These holes should be filled in order to decrease the possibility of pests to enter the building.
	Most interior doors are hollow with hollow frames.	X			Replace with solid doors in order to eliminate places for pests to live.
	Drop-ceiling tiles showed signs of water-damage.	X		X	Replace water-damaged material. Remove standing water and regularly clean areas that are prone to water accumulation.
	Mulch leads to the exterior of the building.	X			Allow at least one foot between mulch and building in order to eliminate habitat options for pests.

IPM in the Curriculum

For the sake of the environment, and for the health of young students, there are undeniable reasons for to adopt an IPM approach in the schools. These reasons intensify when we consider the curricular opportunities they also provide. Integrating IPM into the curriculum for students is an exciting strategy and one with endless opportunities. IPM offers lessons for students in ecology, mathematics, literature, and citizenship. Many organizations are currently involved in helping schools implement IPM. For example, the Environmental Protection Agency (EPA) is distributing printed publications, awarding grants to help schools begin IPM Programs, offering workshops and courses, and providing guidance through partnering schools with area universities (for more information, look at www.epa.gov/pesticides/ipm/). Teachers have available many resources to help incorporate aspects of IPM into their lesson plans. The next few sections highlight a few of the opportunities for making IPM not just a method for managing pests but also a strategy for teaching students.

Curricular Opportunities

Possibilities to teach students about ecological relationships, environmental health, environmental writing, among many other topics, exist at all grade levels. While resource information will be provided to think about lower grade levels, in this guide we emphasize Granville High School as an example of how IPM may be incorporated into the curriculum. Information on current high school courses was gathered through a meeting with a teacher of Ecology from Granville High School. The class is mainly theory based, with projects undertaken throughout the year. The primary focus of the class involves subjects related to the physical

environment, conservation biology (biodiversity), and large-scale ecology. Currently, pest management issues are not incorporated in the curriculum but there is opportunity for implementation.

IPM could be included in a number of different ways in the Granville High School Ecology course. With reference to the syllabus of this course, IPM fits well into the section titled "Communities and Ecosystems." As part of a discussion of food webs or succession and stability students might discuss Carson's keen observations (replicated many times since) of the effects of DDT moving through the food chain. As humans, we effect change in the ecosystem. By putting chemicals into the environment, we are threatening the health of ourselves and other species. Another opportunity for IPM in the curriculum could be under the general title of "The Science of Ecology." Bugs are not solely pests; they are an integral part of the wider ecosystem. Understanding the important environmental services provided by bugs as decomposers and detritivores is an important component of ecology.

An exciting piece of literature that may spark the interest of students is the book *Silent Spring* by Rachel Carson. Currently, the Ecology class reads excerpts from this book. The book was first published in 1962 and the overall message endures today. By reading *Silent Spring*, students gain a better understanding of chemical and biological implications that stemmed from the increased use of harmful pesticide in previous decades. Since this book is a remarkable and historically significant piece of environmental writing, it is also applicable to English courses. Thus Science and English curricula might mutually benefit through a coordinated exploration of IPM-related topics.

Another opportunity to integrate IPM within the curriculum is via mathematics. Specific activities are to have students draw graphs of pest populations as part of ongoing monitoring

efforts, or to conduct cost-benefit analyses comparing IPM with other pest control methods. A discussion of IPM would be also be appropriate with class material that deals with environmental ethics or human health and safety. One of the most important aspects of teaching IPM is to ensure that students understand the dangers of chemical use and the harmful effects to all people who come in contact with pesticides.

Information on curricular links is available in a variety of forms, including resources for teachers and include reports, handouts, media or other tools. Many teachers give handouts to students, and one particularly informative one we have identified is that Pyramid of IPM tactics (See "IPM Resources for Teachers, p. 51). Exact use of the pyramid and other materials depends on the particular grade level in which it is being used.

Opportunities to integrate IPM in K-8 education abound; our focus on the High School curriculum is not meant to deny that. We suggest three primary ways to integrate IPM in the Granville High School curriculum. One is to do hands-on projects with the students such as inventory of pests in the classroom along with a session devoted to learning best strategies to deal with pest problems. A second is an assignment to analyze areas where pests may live in a student's home and to have the student write a summary or report on the IPM strategies to deal with the pests. Finally, we encourage that students be required to read *Silent Spring* and then discuss this reading in class. "IPM Resources for Teachers" (p. 51) will provide many exciting additional ideas. Immediately below we describe how IPM has been adopted as a pest management strategy and integrated in the curricula of Pennsylvania schools.

Pennsylvania Schools: A Model for IPM

The State of Pennsylvania has been a forerunner in the implementation of IPM in schools and provides a fantastic model for other states to look toward. The School IPM Program of Pennsylvania, PAIPM, has been implemented through two main goals (1) Management and (2) Education. The information in the following discussion is drawn from their extensive website (see References Cited).

Management Components of the PAIPM Plan

The management goal as identified by PAIPM is "to facilitate the implementation of IPM strategies to manage pests on school grounds" (PAIPM School IPM, n.d.). The basic idea behind the management goal for Integrated Pest Management is to create an environment that reduces the access that pests have to food, water, and shelter. This, in turn, helps to reduce the number of pests and the amount of pesticides being applied to combat them.

The PAIPM Program in schools has implemented a rigorous management regime of prevention, sanitation, maintenance, monitoring, and record keeping to reduce their reliance on pesticides. This includes the discontinuation of routine pesticide spraying in favor of spot treatments on an as-need basis. In all cases, the use of a least toxic material is stressed and is applied in such a way as to ensure the safety of teachers and students in the school environment. A committee from Pennsylvania School Boards Administration and PAIPM drafted "A Model Integrated Pest Management Policy for Schools" to aid school officials in the implementation of IPM in their own schools. In this model three suggestions clearly emerge (1) Designate a school district employee to be IPM coordinator, (2) Form a stakeholder advisory group that may consist

of parents, students, teachers, school maintenance personnel, school administrators, pest management professionals, air quality experts, etc., and (3) Write an IPM policy pursuant to local needs and conditions. In addition, they urge schools to not only look toward this model as a guide, but also to determine the IPM policy most appropriate for its individual needs.

Specific guidelines are also outlined for management techniques. The steps most important for an Integrated Pest Management decision outlined by the Pennsylvania School Boards Administration are (1) Pest species identification, (2) Estimate pest populations and compare to established action thresholds, (3) Select the appropriate management tactics based on current on-site information, (4) Assess effectiveness of pest management, and (5) Keep appropriate records. Integral to the effective implementation of the IPM plan are these components, all which would be useful in Granville Schools include:

1. IPM Cafeteria Inspection List: a list which outlines appropriate cleaning and maintenance practices in addition to potential problem areas that should be watched.
2. IPM Pest Sighting Log: a log where school staff can write down pest problems or areas of concern.
3. IPM Policy Statement: a statement which outlines an appropriate Integrated Pest Management Policy that seeks to reduce the amount of pesticides sprayed in schools. This policy must outline a specific purpose and a means of achieving these goals.
4. IPM Advisory Committee: a committee made up of parents, teachers, and/or school official that are well educated in IPM and can provide recommendations, implementation ideas, and advise on an IPM program within the school.
5. Inspection Reports: this includes anything from spraying logs to daily inspection charts. These report simply document the practices of the school in regards to pest management so these practices might be reviewed and improved in the future.

IPM Management in Granville Schools

Accomplishing the same management objectives within Granville Schools would not be a difficult goal due to the strong support network of parents, teachers, and administrators. We have found that one of the strongest aspects of the Granville School system is the community/parent involvement. Many of the Pennsylvania communities have formed IPM Advisory Committees composed of teachers and parents. These committees oversee any decisions that can be directly linked to IPM principles and try to solve problems in ways that promote a safe learning environment for children. These advisory committees often utilize the help of someone specifically trained in IPM management.

The most important aspect of the management objective is to get the school on a regular monitoring/maintenance plan where preventative measures are taken to insure that no pest problems exist. An assessment has been included in this report along with recommendations on how Granville can begin to make the steps toward an IPM program. By beginning to correct the structural/management problems outlined, the school district will begin to move closer to the goal of reducing both the amount and intensity of pest problems as well as the use of pesticides. Providing no food, water, or shelter for pests is the key. Specific management techniques that can be utilized within the school are Cafeteria Inspection Lists and Pest Sighting Logs. These can be used as resources to alert the administration to potential problems and their solutions.

Awareness is an important first step. Alerting parents as well as school staff to the use of pesticides in schools before they are applied is important. This may involve sending a note home or a community bulletin about the type of pesticide that is sprayed, how much, and when.

Educational Components of the PAIPM Plan

The educational goal as identified by PAIPM is: "To move IPM principles and activities into K-12 curriculum as an example of interdisciplinary, environment-oriented problem solving" (PAIPM School IPM, n.d.). The State of Pennsylvania has worked actively to implement IPM into the student curriculum of schools to foster knowledge and promote its use to students. In 1998, a memorandum of understanding was signed between representatives of Penn State's College of Agricultural Sciences and College of Education along with Pennsylvania's Department of Agriculture and Department of Education. The agreement allows the signing parties to work together to develop IPM educational materials for use in the state's public school system, conduct educational programs on IPM, and promote the voluntary adoption of IPM use on school grounds statewide. An important advance in Pennsylvania is that IPM was integrated into the curriculum, an endeavor made easier by having made IPM one of nine components of the Academic Standards in Environment and Ecology for the State. These grade-specific standards, as outlined below provide additional ideas of how IPM might be integrated the curriculum in Granville.

Elementary School: Grade 4

It is expected that in Grade 4 students will know types of pests, and be able to:

- Identify classifications of pests.
- Identify and categorize pest
- Know how pests fit into a food chain

It is also expected that students be able to explain pest control, including:

- Knowing reasons why people control pests.
- Identifying different methods for controlling specific pests in the home, school and community.
- Identifying chemical labels (e.g., caution, poison or warning)

A final curricular objective is that students understand society's need for integrated pest management and

- Identify integrated pest management practices in the home.
- Identify integrated pest management practices outside the home.

Middle School: Grade 7

It is expected that in Grade 7 students will be able to explain the benefits and harmful effects of pests, including:

- Identification of different examples of pests and explanation of the beneficial or harmful effect of each.
- Identification of several locations where pests can be found and comparison of the effects the pests have on each location.

Students are also expected to explain how pest management affects the environment, including:

- Explain issues related to integrated pest management including biological technology, resistant varieties, chemical practice, medical technology and monitoring techniques.
- Describe how integrated pest management and related technology impact human activities.
- Identify issues related to integrated pest management that affect the environment.

Finally, students are to explain various integrated pest management practices used in society:

- Compare and contrast integrated pest management monitoring methods utilized in different community settings.
- Compare integrated pest management to past practices.
- Compare and analyze the long-term effects of using integrated pest management products.

High School: Grade 10

It is expected that 10th grade students will be able to identify similar classifications of pests that may or may not have similar effects on different regions:

- Identify environmental effect(s) of pests on different regions of the world.
- Identify introduced species that are classified as pests in their new environments.

Also, students should be able to analyze health benefits and risks associated with integrated pest management:

- Identify the health risks associated with chemicals used in common pesticides.
- Assess various levels of control within different integrated pest management practices including increased immunity to pesticides, food safety, sterilization, nutrient management and weed control.

And finally, at this grade level, determination of the effects of integrated pest management practices on society over time include:

- Analyzing the risks to the environment and society associated with alternative practices used in integrated pest management.
- Analyzing the benefits to the environment and society associated with alternative practices used in integrated pest management.

High School: Grade 12

High School seniors are expected to research integrated pest management systems, including:

- Analyzing the threshold limits of pests and the need for intervention in a managed environment.
- Researching the types of germicides and analyzing their effects on homes industry, hospitals and institutions.
- Designing and explaining an integrated pest management plan that uses a range of pest controls.

They also research and analyze integrated pest management practices globally, including.

- Researching worldwide integrated pest management systems and evaluating the level of impact.
- Researching and analyzing the international regulations that exist related to integrated pest management.
- Explaining the complexities associated with moving from one level of control to the next with different integrated pest management practices and comparing the related costs of each system.

Finally, seniors analyze the historical significance of integrated pest management on society:

- Explaining the dynamics of integrated pest management practices and their relative effects upon society.
- Identifying historic events affecting integrated pest management and the practices used (e.g., avian flu, bubonic plague, potato plight).
- Analyzing the long-term effects of pest management practices on the environment.

Applying the Lessons of PA to IPM Education in Granville Schools

Changes within the curriculum will probably be the hardest goal to accomplish within the Granville School system due, in part, to time constraints for teachers. The job in Pennsylvania has been made easier because Pennsylvania has made IPM part of its Academic Standards of Education . Nonetheless, the list above provides some possible ways of introducing IPM into the curriculum at all levels, and to return to the topic in new ways that reinforce earlier learning. We encourage the IPM Advisory Committee (the establishment of which is recommended in this report) to consider ways to accomplish this task. The National School IPM website (see Additional information section) provides ideas for teaching aides that could be used by this Advisory Committee or by teachers.

Pest Identification and Control Strategies: A Guide for Granville Schools

This section gives an overview of many of the specific pests found in and around school buildings. IPM promotes the use of research and an understanding of pests to decide the best possible control strategy—without the use of harmful chemicals. The pests discussed below include ants, cockroaches, earwigs, head lice, mice, silverfish, termites, and yellow jackets. These are the most common pests in the surrounding region. A description of each pest and its habitat is described; IPM methods of control are briefly reviewed, including non-pesticide products which may be safely used.

Ants

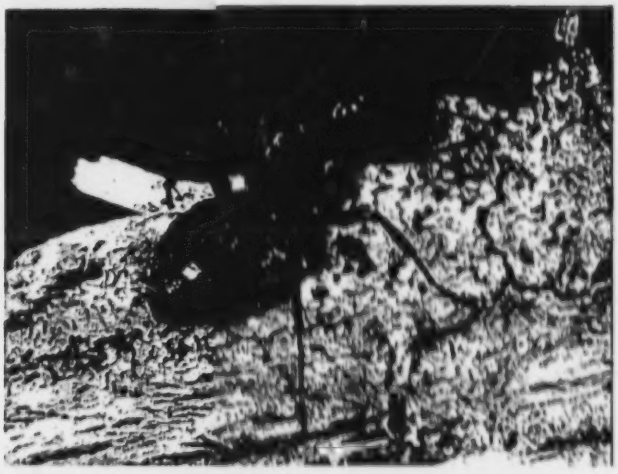

photo source: www.antcontrols.com/carp.htm

Carpenter Ants (*Camponotus pennsylvanicus*):

Description: Carpenter ants may come both in winged and wingless forms, but are most commonly wingless. Carpenter ants are the largest of the ant family, and range from 1/4 to 3/4 inches. Carpenter ants are black, reddish-black or brownish black in color, have a constricted waist, and bent antennae.

Habitat: Carpenter ants prefer damp or moist areas to make their home. Carpenter ants generally live in the heartwood of dying trees. Especially vulnerable areas to invasion by carpenter ants are sections of rotting wood. Carpenter ants follow the grain of the wood to make their tunnels. The chewed wood is pushed out of the tunnel, and nests can be found by locating areas where this chewed, sawdust-looking wood is located.

IPM Methods: One main way to control carpenter ants is by not providing them with a suitable habitat. Because carpenter ants find homes in damp wood, it is important to reduce or prevent moisture for occurring in wood. The removal of any kind of wood that is decaying from the structure where carpenter ants are found is also another useful means of elimination.
Carpenter ants may also feed on garbage, so another means of control is to seal garbage containers so that the ants will not have that as a possible source of food.
A physical means of removing the ants is through vacuuming up ants in the nest area. However, it is important to dispose of the vacuum bag with the ants in it.
Another means by which to destroy an ant colony if the location of the nest is known is through pouring boiling water in the nest in order to kill the ants.

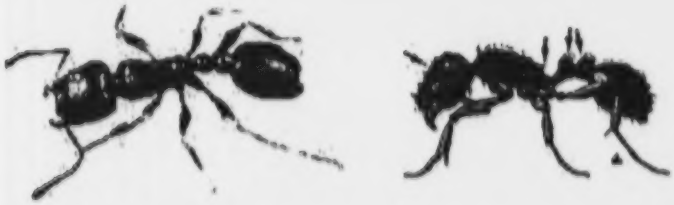

photo source:
www.pestworld.org/homeowners/spotlight/pavement_ant.htm

Pavement Ants (*Tetramorium caespitum*):

Description: The pavement ant is generally ranges from 1/10 to 1/8 of an inch in length and varies in coloration from brown to black in color. They commonly eat seeds, insect remains, meats and greasy materials.

Habitat: This species of ant generally makes its home under stones and in or under edges of pavement. During the winter pavement ants will nest near a heat source, which may include in or around houses.

IPM Methods: Although finding pavement ant nests can be difficult, it is most useful if the site of the nest can be found. Sealing cracks and gaps in walls and in the foundation can be useful in eliminating entry of pavement ants into a building. Pavement ants enter the home in search of food and water so it is important to keep floors clean of food. Behind appliances also make very nice homes for pavement ants because they may not only provide food, and possibly water, but also a source of heat. Outside of the building the foundation should be kept clean of leaves, vegetation and other such debris.

Non-pesticide products:
*Barrier Treatment- provides up to 4 weeks of control, all ingredients are approved as food additives (By Bioganic-http://www.bioganic.com or 1-877-723-3545)
*Dust insecticide- water resistant, non-corrosive, non staining- crack and crevice protection- active ingredients made from plant oils (By Bioganic-http://www.bioganic.com or 1-877-723-3545)
*Diatomacious earth—fossilized diatoms that kills insects by dehydration followed by death, possible to irritate eyes and lungs if DE comes in contact with them
*Silica Aerogel—basically made from sand, insects become dehydrated which is then followed by their death

Cockroaches

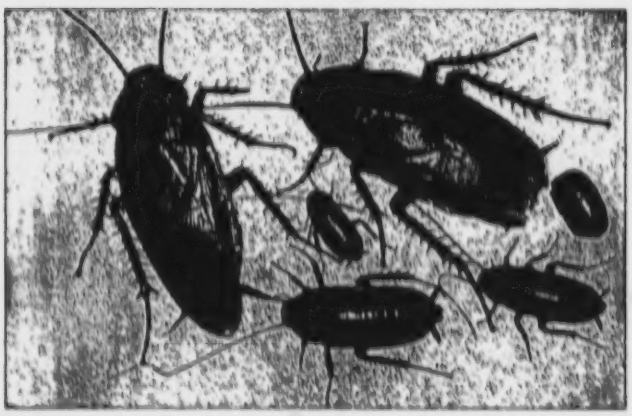

photo source: http://pested.unl.edu/roachind.htm

American cockroach (*Periplaneta americana*): This species of cockroach ranges from 1 ½ to 1 ¾ inches in length. They are reddish brown. They tend to live in wood piles, decaying trees, and eat a variety of foods. They are generally found in the basement and on ground floors in warm, moist areas. Adults cockroaches of this species are capable of flying.

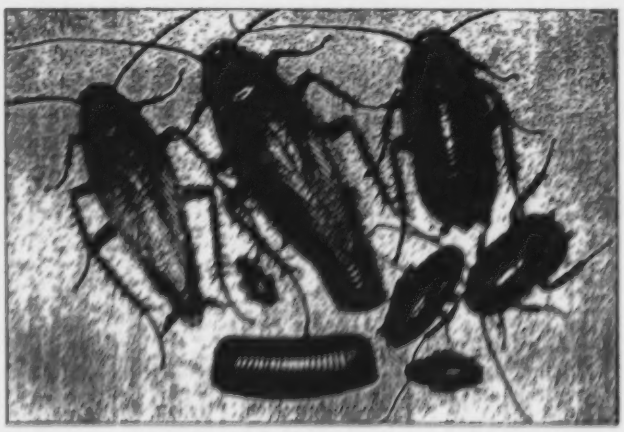

photo source: http://pested.unl.edu/roachind.htm

German cockroach (*Blattella germanica*): This species of cockroach is from ½ to 1/8 of an inch long. It prefers warm, moist, dark, crevices.

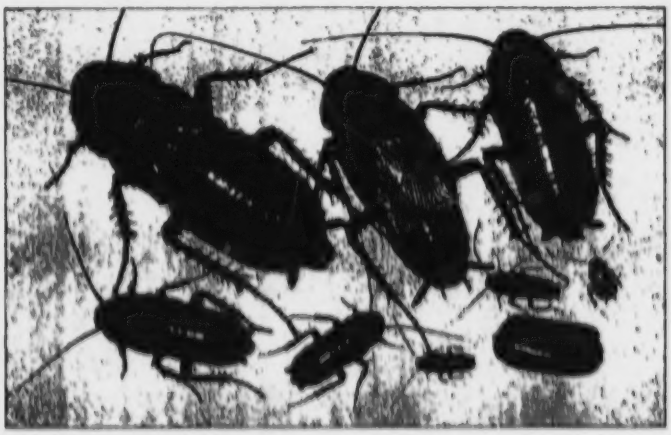

photo source: http://pested.unl.edu/roachind.htm

Oriental Cockroach (*Blatta orientalis*): This species is generally 1 ¼ inches long and prefers to live in areas with excessive moisture. They tend to live in sheltered, but more or less open spaces.

Habitat: The presence of cockroach populations in and around urban structures is an indication that food, moisture and harborage resources are present. These conditions allow cockroach population explosions. During the day cockroaches can live in baseboards, closets, cabinets, under stoves, dishwashers, refrigerators, and under sinks.

Description: Large indoor cockroach populations are one of the leading causes of allergies, asthma and other bronchial disorders in humans. Additionally, cockroaches are capable of carrying disease organisms and bacteria on their bodies and in their fecal material. Most cockroaches have long antennae, spiny legs, flat oval shape, and wings. Although they have wings they rarely fly.

IPM Methods: Because of multi-chemical resistance among German cockroach populations, non-chemical means of elimination are becoming necessary for controlling this pest. Two main components of eliminating cockroach problems are through sanitation and through preventing entry into buildings. Sticky glue traps may be useful in finding areas of infestation.
In order to reduce entry of cockroaches, gaps around plumbing, wall outlets, and switch plates should be sealed. Cracks and gaps should also be caulked to reduce entry from outdoors. Dry drain traps are also a point of entry for cockroaches. Periodically run the water in spare bathrooms, utility tubs and toilets to keep the drain trap filled and off limits to cockroaches. Children can transport cockroaches from home to school and from school to home in book bags and lunch pails.

Non-pesticide products:

*Victor Cockroach Pheromone Traps- 96 traps for $38.45 (can be ordered by calling 1-800-992-1991)
*Lo Line Cockroach Traps-Sticky traps that trap nymphs, adults, and eggs-contains a lure (pheromones) that attracts all cockroach species from their harborages (By Agri Sense, P.O. Box 674, Wabasso, Fl 32970 Phone/Fax: 1-561-589-6762)
*Barrier Treatment- provides up to 4 weeks of control, all ingredients are approved as food additives (By Bioganic-http://www.bioganic.com or 1-877-723-3545)

Earwigs

photo source: http://phylogeny.arizona.edu/tree/eukaryotes/animals/arthropoda/hexapoda/dermaptera/dermaptera.html

Earwigs (*Forficula auricularia*)

Description: Earwigs are a nuisance pest which can sometimes build up to high populations during warm weather. They are primarily nocturnal scavengers on decaying animal and plant material. Earwigs have "pinchers" on their posterior end, and they may pinch if they are handled.[5] Earwigs can be up to 1 ½ inches in length and are red-brown to black in color. Some species are wingless and others have small, leathery, forewings that cover only a few sections of the abdomen with forewings protruding from them.

Habitat: Earwigs can usually be found along foundations of homes or under crawl spaces. They prefer cool, damp areas and may enter homes through cracks and ducts. Mulched flower beds and compost piles are conducive to having earwigs present. They are most active during the night, and during the day they find shelter beneath stones, boards, sidewalks, or other debris.

IPM Methods:
One of the best ways to minimize earwig problems to begin with is to keep areas close to the building and foundation clear of debris and other potential earwig hiding places.
One non-chemical method by which to get rid of earwigs is through rolling up newspapers, moistening them, and putting the moistened newspaper in areas infested with earwigs. Earwigs will crawl into the rolled up newspaper and remain there because their habitat consists of tight, damp areas. Every day the newspapers should be removed and earwigs should be crushed or disposed of in some other manner.
A biological control is the tachnid fly (Bigonicheta spinnipennis). It is an internal parasite of earwigs, but has only shown limited potential in controlling their populations.

Non-pesticide products:
*Dust insecticide- water resistant, non-corrosive, non staining- crack and crevice protection- active ingredients made from plant oils (By Bioganic-http://www.bioganic.com or 1-877-723-3545)

Head Lice

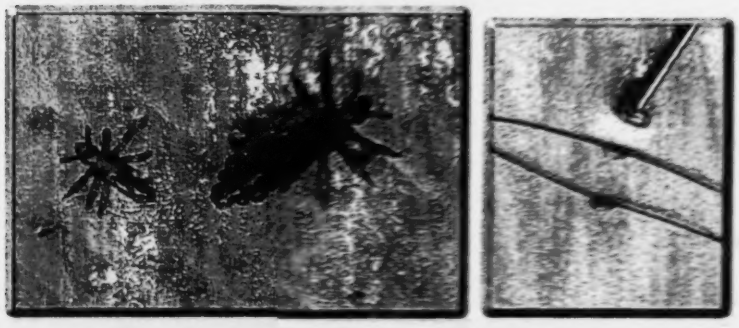

photo source: http://www.headlice.org/faq/faqlice/lousology.htm

Head Lice: (*Pediculus humanus capitis*)

Description: Head lice are six legged insects which do not have wings or powerful jumping legs to transport themselves from human to human, but instead cling to hair with claw-like legs. An adult head louse is approximately 2.5 to 3.5 mm long. Children are generally most effected by head lice, but adults may also contract them. In the United States, head lice are not considered to be a transporter of disease, but may cause secondary infections in serious infestations due to scratching.

Habitat: Head lice feed on human blood, and it is necessary for them to survive. Head lice off of their human hosts will starve. Head lice generally do not survive for more than 24 hours off of a human host. Head lice are not found on animals or pets and thus are not transmitted from pets to humans.

IPM Methods: At a child's home pillowcases, sheets, nightclothes, towels and stuffed animals should be washed and dried under high heat. All hair accessories that have come in contact with an infested individual should be washed in hot water to remove any lice or nits.

As far as schools are concerned, there should be the implementation of a "no nit" policy. This policy would not allow students who have lice to come to school. In addition to this, students would not be allowed to return to school until their hair had been found free of any nits. If a "no nit" policy is not put into place there is a greater chance that lice will be spread more quickly among the students. In addition to this, when an outbreak occurs, letters should be sent out to all parents making them aware that their child may become infected with head lice and the letter should ask the parents to inspect their child's hair.

With a no-nit policy, however, if a "no-nit" policy is put into place, children would be excluded from the classrooms each year, and has the potential to greatly effect the learning process.

Non-pesticide products:

*Lice B Gone- contains no harmful pesticides, solves lice problems with one application, $15.99 for four treatments (By Safe Effective Alternatives, Inc., P.O. Box 528, Belleville, IL 62222 Phone: 1-877-730-2727, Fax: 618-236-2826, E-mail: info@s-e-a.net
www.s-e-a.net/

*Olive oil- the Harvard School of Public Health has confirmed that olive oil kills active head lice by smothering them. This may be especially effective due to chemical resistance found in some head lice.

*Not Nice to Lice- (By Pestisafe-2454 Mesquite Ln. Corona, CA 92882 Phone:1-909-372-9850
www.safe2use.com

*Herbo-ingredients derived solely from plants and herbs and is 100% water based $24.99 per kit (two 12 oz bottles) (By Merryland Group 317 West Main Street, #101, Alhambra, CA. 91801 U.S.A E-mail: www.ultraliceinfo@yahoo.com Website: http://www.ultralicex.com)

Mice

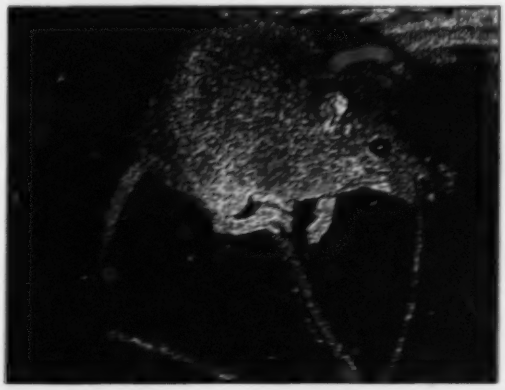

photo source:
http://www.npwrc.usgs.gov/resource/distr/mammals/mammals/house.htm

House mouse (*Mus musculus*):

Description: House mice are brown to light gray rodents with somewhat large ears and small eyes. An adult mouse can be from 5 ½ inches to 7 ½ inches in length, which includes the 3 to 4 inch length of their tail. House mice can jump 13 inches from the floor onto a surface, are excellent climbers, and are able to run up rough vertical surfaces. In addition to this, they have excellent senses of smell, sight, and hearing.

Habitat: Mice tend to make nests in sheltered locations from shredded paper or other fibrous material. Areas where droppings, gnawing and tracks are found are areas where the mice are the most active. They feed on cereal grains, as well as many other types of foods.

IPM Methods: Eliminating food sources for the mice is a good starting point. Good sanitation is also important for bad sanitation is a good way to attract mice. Even if sanitation is good, this alone will generally not eliminate a mouse problem. Traps are one of the most effective means of eliminating mice.

Non-pesticide products:
*Mini-Mouser- A multiple catch mousetrap that catches multiple mice in one setting. It requires no baits or chemicals. ($12.90-Kness Mfg. Co., INC. Hwy 5 South, P.O. Box 70, Albia, Iowa 52531-0070 Phone: 1-800-247-5062 Website: http://www.kness.com
*Rat Zapper 2000 (RZ2K)-- Designed for consumer use, kills 10-20 rats or mice with one set of 4 AA alkaline batteries (By AgriZap, Inc.,1860 Eastman Ave, Building 111, Ventura, CA 93003 Phone: 1-888-DEAD-RAT [(888) 332-3728] Fax: 805-654-1390

Silverfish

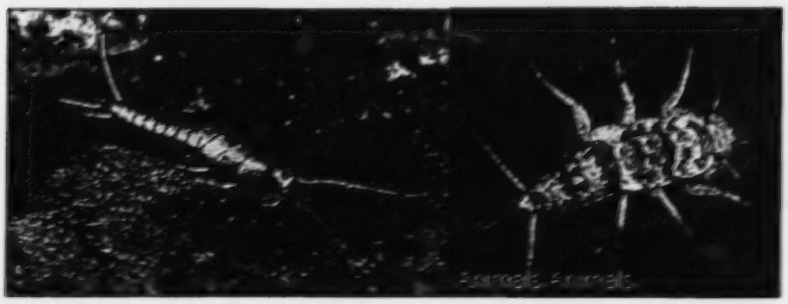

photo source: http://encarta.msn.com/find/Concise.asp?ti=0190A000

Silverfish (*Lepisma saccharina*)

Description: Silverfish have three long tail-like appendages attached to the tapered posterior end, each about as long as the body. These insects are wingless, with chewing mouthparts, long antennae, and their body is covered with scales. The mouthparts of silverfish are used for biting off small particles or for scraping at surfaces. Silverfish are about 1/2 inch long when fully grown, and covered with silvery scales. It is grayish to greenish in color and its body has a flattened-carrot shape.

Habitat: Silverfish prefer a dark, moist environment and require a large supply of starchy foods or molds. Silverfish prefer moist areas from 75 to 97% humidity and moderate temperatures from 70 to 80 degrees Fahrenheit. They are active at night or in dark places and may be found throughout the building. These insects are considered to be nuisance pests that can feed on wallpaper pastes, natural textiles, books, and manuscripts. They also feed on mold that grows on various surfaces. Silverfish eat material high in protein, sugar, or starch, including cereals, moist wheat flour, starch in book bindings, sizing in paper, and paper on which there is glue or paste. These insects often attack wallpaper, eating irregular holes through the paper to get to the paste. Silverfish may bite very small holes in various fabrics, including cotton, linen, and silk, even though they cannot digest either linen or cotton. They may leave yellowish stains on fabric.

IPM Methods: One way in which to discourage silverfish is by reducing the moisture that the insects rely upon for survival. Some ways to go about this may be through fixing leaking pipes, ventilating closed rooms and attics, eliminating standing water, and by using a dehumidifier.

Another way in which to remove these pests is through vacuuming cracks and crevices to physically remove the insects.

Because silverfish rely upon mold and starch from book bindings, periodic airing and drying of articles stored in damp areas may help reduce silverfish. Disposing of moldy articles is often the simplest way of removing an infestation in an area.

Non-pesticide products:

*Dust insecticide- water resistant, non-corrosive, non staining- crack and crevice protection- active ingredients made from plant oils (By Bioganic-http://www.bioganic.com or 1-877-723-3545)

*Diatomacious earth—fossilized diatoms that kills insects by dehydration followed by death, possible to irritate eyes and lungs if DE comes in contact with them

Termites

photo source: http://www.hiltonpond.org/ThisWeek010129.html

Eastern Subterranean Termite (*Reticulitermes flavipes*):

Description: Termites are social insects that live together in colonies and have a castes system. Worker termites are the caste that are responsible for going out and collecting food. Workers are white to grayish white and are generally ¼ to 3/8 inches in length. A sign that termites may be present within a school is pencil-sized tubes of mud that are found on foundation walls. Another sign of termite infestation is mud in between boards and beams. When tapping on wood, if a hollow sound is heard, or if the wood seems to be very soft may also be an indication of the presence of termites.

Habitat: This species of termite needs to be near a source of moisture and thus generally live in contact with soil. However, these termites may be found above ground and receiving moisture from alternative sources such as air conditioners. Termites make tunnels into soft wood and in the ground so that they do not dry out and so that they are hidden from predators.

IPM Methods: Because termites are attracted to moisture, it is important to take measures to ensure that moisture is removed from the foundation. The slope around the building should be set up so that water runs off away from the building. In addition to this, downspouts should be in place, functioning, and be directed away from the building.

One of the most important things that can be done to discourage termites is the elimination of any wood contact with the soil. There should be an 18-inch gap between the soil and all wooden portions of the school building.

Wood mulch around buildings may attract termites, especially if it is moist. Alternatives such as pea gravel or crushed stone are less likely to attract termites as well as other insects.

When building new buildings, wood scraps should never be buried and especially no where near the building. All stakes, boards and other wooden pieces should be removed from the construction site after the building is completed.

Non-pesticide products:
* Silica Aerogel—basically made from sand, insects become dehydrated which is then followed by their death, should be placed in wall voids and attics to repel termites.
*Bio-Blast—uses the fungus Metarhizium anisopliae, to eliminate termites. It is odorless, vaporless, no staining and infected termites can pass the fungus to other termites through the horizontal transfer effect (By EcoScience Corporation, 17 Christopher Way, Eatontown, NJ 07724-3325 Phone: 1-732-432-8200 Website: www.ecosci.com/bioblast/index.html
*Nematodes—this parasitic roundworm can be used in the control of termites and may be useful in controlling other soil insects as well

Yellow Jackets

photo source: http://www.greensmiths.com/yellow_jacket.htm

German Yellow jacket (*Paravespula germanica*):
Eastern Yellow jacket (*Paravespula maculifrons*):

Description:
Yellow jackets are bright yellow with black stripes. Although they are the same size as honey bees, yellow jackets have very little hair compared to hair covered honey bees. In the Midwest, there are two common species of yellow jackets; the eastern yellow jacket, which nests in the ground and the German yellow jacket which may be commonly found nesting in wall voids of structures. The average worker yellow jacket is approximately 1/2 inch long.

Habitat:
Single queens begin building their nests in the spring, usually in May. By June, some female workers will have emerged, and by mid-August, the number of yellow jackets reaches its peak with anywhere from 1,000 to 5,000 workers in a nest. (www.ipm.uiuc.edu/publications/inforsheets/103-yellowjacket/mj.htm). Generally, the nests are built no more than 400 meters from a protein source or one kilometer from a honey source.

IPM Methods:
One of the most effective means by which to reduce yellow jacket problems is through eliminating food sources. Garbage cans should have fitted lids to keep yellow jackets away, and garbage cans should always be kept clean and washed out.

One way in which to eliminate a ground nest of yellow jackets is to place a clear bowl over the entranceway to the nest. The edges of the bowl should be buried as to complete a seal

with the ground. Yellow jackets will continually try to exit their nest, and because the bowl covering the entrance is clear and they can still see the sky, the yellow jackets will not try to dig another exit from their nest. After a few weeks the colony will starve and thus all of the yellow jackets within the colony will die.

Vacuuming by a professional can be used for nests that are underground, in structures, and aerial nests.

Traps can also be used for the removal of yellow jackets. Food attractants or pheromones can be used to entice the yellow jackets. It is important to keep in mind that if toxic baits are used, this may not only effect the yellow jacket population, but may also poison yellow jacket's natural predators such as birds, skunks, and raccoons.

Non-pesticide products:

*Oak Stump Farm Yellow Jacket Wasp Trap-easy to clean without being stung, captures large numbers of yellow jackets (By Oak Stump Farm, Inc. phone: 1-973-812-7070)

* Yellow Jacket/Wasp Trap with Bait-easy to use, non-toxic, long lasting protein bait, replacement baits available; $6.79 each; 2 Pack Replacement Baits $2.98 per 2 pack (By Seabright Laboratories, 4067 Watts Street, Emeryville, CA 94608-3604 Phone: 1-800-284-7363 Fax: (510) 654-7982 Email: stikem@seabrightlabs.com)

Conclusion

Throughout this past semester, the Environmental Studies Senior Capstone Seminar researched the advantages of IPM and how these apply to a school setting such as Granville. We first placed IPM within the context of overall concern for human health and the dangers of pesticides in the environment. We stress that children are especially vulnerable to the effects of pesticides, and thus urge that special efforts be made to avoid their use in the schools.

Our work included an assessment of pest management strategies in the Granville Schools. The schools are fortunate in that currently there are not major problems with which to contend. Yellow jackets, ants, cockroaches, and occasional rodents are the primary pests. Wisely, the school does not spray on a routine basis; pest problems are dealt with on an as-needed basis. Inarguably, though, as the schools system expands and as school buildings age, the school district can reasonably expect that pest problems will worsen, not improve. Adoption is IPM is nonetheless valuable, in that it promotes taking a proactive stance to prevent further problems before they develop. In addition, having a policy in place that will guide decision making about pest treatment, when needed, means that future action will be consistent with concern for the environment and for human health. The behavioral and structural problems identified in the assessment can be relatively easily dealt with, using the recommendations provided here, all of which reflect an IPM philosophy.

In addition to practicing IPM as pest management, we hope we also have encouraged the schools to give serious consideration to the possibility of adopting IPM as education: education about ecology, about population, about literature, mathematics, or good citizenship. The possibilities are broad, and we have identified many of the resources that exist to help you on this

endeavor. We might argue that to truly achieve *integrated* pest management, this incorporation in multiple facets of the schools is necessary.

We recommend that the next step the schools should take to continue with this work is to create an IPM Advisory committee, representing administrators, maintenance staff, parents, and teachers. An additional step is to adopt a policy statement establishing a clear set of goals for IPM implementation. We encourage the Granville school system to adopt the following statement as an overall plan of action in an effort to reduce pests and maintain student safety:

> *We, Granville Schools, plan to implement cost effective pest management utilizing the philosophy of IPM which both protects the environment and our children.*

Links for Additional Information

General Resources

(1) **Bio-Integral Resource Center (BIRC)**
www.birc.org

Center devoted to finding non-toxic and least-toxic, integrated pest management solutions to urban and agricultural pest problems. Publishes the "IPM for Schools: A How-to Manual."

(2) **IPM in Schools**
http://schoolipm.ifas.ufl.edu/

Offers information for schools looking to utilize IPM, including technical information for IPM design.

(3) **IPM Institute's School IPM Website**
www.ipminstitute.org/school.htm

A website where you can purchase "IPM Standards for Schools: A Program for Reducing Pest and Pesticide Risks in Schools and Other Sensitive Environments." This is a new initiative that can provide answers to questions regarding IPM. This also offers additional links and standards for IPM implementation in schools.

(4) **National School IPM Website**
www.ifas.ufl.edu/~schoolipm/

Gives general IPM information in addition to a teaching curriculum and teaching aides.

(5) **Nationwide Directory of IPM in Schools**
www.eps.gov/reg5foia/pest/mantill/ipm_dir.html

Offers a comprehensive directory of IPM implementation information in individual states. Contact names and number are provided.

(6) **Pennsylvania IPM School IPM Program**
http://paipm.cas.psu.edu/schools/schoolipm.html

Provides detailed information on Pennsylvania's use of IPM to management pests in school and as educational materials and activities exemplary of interdisciplinary, environment-oriented problem solving.

Resources for Managing Pests

(1) **General Information**:
Daar, Sheila, Tanya Drlik, Helga Olkowski, and William Olkowski
IPM for Schools: A How-To Manual

The definitive source for IPM strategies for dealing with pests in schools, available from the Bio-Integra Resource Center, P.O. Box 7414, Berkely, CA see also http://www.birc.org/

Purdue University Extension Entomoloy
www.entm.purdue.edu/entomology/ext/targets/e-series/househol.htm

(2) **Carpenter Ants**
Environment Canada:
http://199.212.16.18/epb/factsheets/bkyard_bug/carpenter_ant.html

(3) **Pavement Ants**
Virginia Cooperative Extension:
www.ext.vt.edu/departments/entomology/factsheets/pavement.htm

Iowa State University Entomology Department:
http://www.ent.iastate.edu/ipm/iiin/apavement.html

F + W Pest Control:
http://www.fwpest.com/pavement.html

(4) **Cockroaches**
University of Florida School IPM:
www.schoolipm.ifas.ufl.edu/tp4.htm

(5) **Earwigs**
Purdue University Plant and Pest Diagnostic Laboratory:
www.ppdl.purdue.edu/ppdl/expert/Earwigs.html

Virginia Cooperative Extension:
www.ext.vt.edu/departments/entomology/factsheets/earwigs.html

California Department of Food and Agriculture:
www.cdfa.ca.gov/agfacts/pesticides/earwigs.html

(6) **Lice**
University of Florida School IPM:
www.schoolipm.ifas.ufl.edu/tp2.htm

National Pediculosis Association:
www.headlice.org

Head Lice International Center for Education:
www.hlice.com/licefaq.htm#_No_nit_policy

(7) **Mice**
University of Illinois Department of Crop Sciences IPM
www.ipm.uiuc.edu/publications/infosheets/101-mouse/mm.htm

(8) **Termites**
Ohio State University Extension:
www.ag.ohio-state.edu/~ohioline/hyg-fact/2000/2092.html

(9) **Yellowjackets**
University of Illinois Department of Crop Sciences IPM
www.ipm.uiuc.edu/publications/inforsheets/103-yellowjacket/mj.htm

IPM Resources for Teachers

(1) **Alien Empire**
http://www.pbs.org/wnet/nature/alienempire/

The multimedia companion to the mini-series by the same name presented as part of PBS's Nature.

(2) **The University of Arizona Center for Insect Science Education Outreach**
http://insected.arizona.edu/home.htm

Includes "Using Live Insects in Elementary Classrooms for Early Lessons in Life," and "Acres of Insects."

(3) **Insecta Inspecta World**
http://www.insecta-inspecta.com/

An incredible web site designed by 7th graders that educates and entertains.

(4) **Iowa State University Department of Entomology**
http://www.ent.iastate.edu/List/k-12_educator_resources.html

The site is devoted to providing resources of interest to K-12 educators.

(5) **The University of Kentucky Department of Entomology**
http://www.uky.edu/Agriculture/Entomology/ythfacts/resourc/resourc.htm

Includes the educational game "Bug-Go" and lesson plans for insects in the classroom.

(6) **The University of Minnesota Integrated Pest Management Program**
http://www.mda.state.mn.us/ipm/IPMPubs.html

Includes "Join Our Pest Patrol - A Backyard Activity Book for Kids - An Adventure in IPM."

(7) **Pennsylvania School IPM Program**
http://paipm.cas.psu.edu/schools/schoolEduc.htm

Includes IPM Pyramid of Tactics for Schools, Insect Olympics Activities, and more.

(8) **Rachel Carson Council Teacher's Packet**
order at http://members.aol.com/rccouncil/ourpage/

Includes games, activities, and fact sheets.

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1992 *Position Statement on The Use of Pesticides in Schools and Child Care Centers.*
www.pesticide.org/NatPTA.html

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2000 *Unthinkable Risk: How Children are Exposed and Harmed When Pesticides are Used at School.* www. pesticide.org

Pennsylvania IPM School IPM Program
n.d. *School IPM.*
http://paipm.cas.psu.edu/schools/schoolIPM.html

Physicians for Social Responsibility
2000 *Physicians for Social Responsibility Statement on Pesticides in Schools.*
www.psr.org/pestschool.html

Rachel Carson Council
n.d. *Understanding Pesticides.* Rachel Carson Council, Chevy Chase, MD.

United States Environmental Protection Agency
n.d. *Pesticides/Toxic Chemicals & Children.*
http://www.epa.gov/unix0008/children/childhealth/pesticides/pesticides.html

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